Exploration of the Ocean Cavities Beneath Antarctica's Floating Ice Shelves Using Autonomous Underwater Vehicles

Adrian Jenkins[1], Pierre Dutrieux[2], Stan Jacobs[2], Hartmut Hellmer[3], Markus Janout[3], Mike Schröder[3], Steve McPhail[4] and Rob Templeton[4]

[1]*British Antarctic Survey, Natural Environment Research Council, Cambridge, UK*

[2]*Lamont-Doherty Earth Observatory of Columbia University, New York, USA*

[3]*Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany*

[4]*National Oceanography Centre, Natural Environment Research Council, Southampton, UK*

Direct interaction between the Antarctic Ice Sheet and the Southern Ocean occurs at the base of the floating ice shelves that form at the margins of the ice sheet. The phase changes that occur at the ice-ocean interface play a key role in determining both the mass balance of the ice sheet, with implications for global sea levels, and the water mass transformations that occur on the Antarctic Continental Shelf, with implications for the global meridional overturning circulation. However, with an ice cover that ranges in thickness from hundreds to thousands of metres, the seawater cavities beneath the Antarctic ice shelves remain among the most inaccessible and unexplored regions of the ocean. Until a decade ago, the only possibilities for direct observation beneath ice shelves were provided by drilling access holes through the ice shelf. Such time consuming operations yielded immensely valuable time-series observations, but could never provide the necessary spatial coverage for a fuller understanding of the sub-ice-shelf system. Recently Autonomous Underwater Vehicle (AUV) technology has advanced to the point where AUVs can provide that spatial coverage. This presentation reviews the achievements of the UK Natural Environment Research Council's Autosub AUVs on campaigns in the Antarctic over the past decade and discusses how the resulting datasets can expand our understanding of the sub-ice-shelf environment and the physical processes by which the Southern Ocean forces change in the Antarctic Ice Sheet.